PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference WO 41770	**FOR FURTHER ACTION**	See Form PCT/IPEA/416
International application No. PCT/IB2004/002304	International filing date *(day/month/year)* 16.07.2004	Priority date *(day/month/year)* 18.07.2003
International Patent Classification (IPC) or national classification and IPC F15B20/00, F15B11/024		
Applicant TOYOTA JIDOSHA KABUSHIKI KAISHA et al		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 6 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 7 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the opinion
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☒	Box No. VIII	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
20.01.2005	25.10.2005
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer Daieff, B Telephone No. +49 89 2399-7229

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/IB2004/002304

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3 and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4)
   - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages

1-14 as originally filed

Claims, Numbers

1-22 filed with the demand

Drawings, Sheets

1/4-4/4 as originally filed

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

* *If item 4 applies, some or all of these sheets may be marked "superseded."*

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-22
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-22
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-22
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item V.

1 The following documents are referred to in this communication:

D1: US 2002/121087 A1 (CASSE CHRISTOPHE LIONEL RENE ET AL) 5 September 2002 (2002-09-05)

Do: GB-A-2 318 426 (ULTRONICS LIMITED ; ULTRA HYDRAULICS LTD (GB)) 22 April 1998 (1998-04-22)

D3: GB-A-2 053 419 (SINGER CO UK LTD) 4 February 1981 (1981-02-04)

D4: US 6 193 627 B1 (BART JOERG) 27 February 2001 (2001-02-27)

2 INDEPENDENT CLAIM 1

2.1 The document D4 is regarded as being the closest prior art to the subject-matter of claims 1 and 14, and shows (the references in parentheses applying to this document):

> A hydraulic control apparatus (28) for a hydraulic servo unit (22, 23) that selectively changes an operation direction between a first direction when an oil is supplied from a first port (29) and discharged from a second port (30) and a second direction opposite to the first direction when the oil is supplied from the second port (30) and discharged from the first port (29), the hydraulic control apparatus being comprised in an toroidal type continuously variable transmission (1).

The subject-matter of claim 1 differs from this known hydraulic control apparatus of a toroidal transmission in that:

> The hydraulic control apparatus comprises
> - a first oil flow control valve and a second oil flow control valve each having an oil supply control portion that controls an oil supply from a pressurized oil source, and an oil discharge control portion that controls a connection with an oil discharge passage,
> - a control valve operation means that controls each operation of the first and the second oil flow control valves,
> wherein the first port receives an oil supply from the oil supply control portion

of the first oil flow control valve, and discharge the oil through the oil discharge control portion of the second oil flow control valve,
wherein the second port receives an oil supply from the oil supply control portion of the second oil flow control valve, and discharge the oil through the oil discharge control portion of the first oil flow control valve, and wherein an operation state of the hydraulic servo unit is controlled by the control valve operation control means that control each operation of the first and the second oil flow control valves

The subject-matter of claims 1 and 14 (being a method of controlling the hydraulic apparatus of claim 1) is therefore new (Article 33(2) PCT).

2.2 The problem to be solved by the present invention may be regarded as to provide an improved control apparatus and method, capable of preventing the servo mechanism from losing normal control in case of malfunction.

The solution to this problem proposed in claim 1 and 14 of the present application is considered as involving an inventive step (Article 33(3) PCT) for the following reasons:

Document D1 discloses an hydraulic control apparatus for a hydraulic servo suited to use on an aircraft. The apparatus differs therefore from the one of claim 1 in that it is not comprised in a toroidal transmission. Furthermore, the combination of the hydraulic control apparatus of claim 1 with a toroidal type continuously variable transmission is also not disclosed or made obvious by the available prior art. In particular, D4 discloses such a transmission type, whereby the control apparatus is provided with only one oil flow control valve to control the operation of the hydraulic servo.

2.3 Claims 2-13 and 15-22 are respectively dependent on claims 1 and 14 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

Re Item VIII.

1. The application does not meet the requirements of Article 6 PCT, because the wording of claims 1-3, 14, 15 and 16 is not clear.

1.1 In claims 1 and 14, the expression "a hydraulic servo unit comprises a toroidal type CVT" is not clear, as only the contrary makes sense. Furthermore, the expression lacks to define the functional relationship between the servo and the transmission. From the description and the drawings, it is clear that the servo is used to deflect the roller, as clearly defined in actual claim 11. Claim 1 and 14 are therefore not supported by the description as required by Article 6 PCT, as their scope is broader than justified by the description and drawings.

1.2 In claims 2, 3, 15 and 16 it is said that "the first (or second) oil flow control valve is only controlled by interrupting the control of the (other) valve that supplies the oil from the pressurized oil source and passes the oil into the oil discharge passage". Firstly, it is not clear how the first (or second) valve can be controlled by interrupting the control of the other valve. Secondly, when the control of the other valve is interrupted, it is not clear how this valve supplies the oil from the pressurized oil source and passes the oil into the oil discharge passage.

European Patent Application No.: PCT/IB2004/002304
Applicant: TOYOTA JIDOSHA KABUSHIKI KAISHA
Our ref: WO 41770

New Claims 1 - 22

1. A hydraulic control apparatus for a hydraulic servo unit that selectively changes an operation direction between a first direction when an oil is supplied from a first port and discharged from a second port and a second direction opposite to the first direction when the oil is supplied from the second port and discharged from the first port, the hydraulic control apparatus characterized by comprising:

a first oil flow control valve and a second oil flow control valve each having an oil supply control portion that controls an oil supply from a pressurized oil source, and an oil discharge control portion that controls a connection with an oil discharge passage; and

control valve operation control means that controls each operation of the first and the second oil flow control valves,

wherein the first port receives an oil supply from the oil supply control portion of the first oil flow control valve, and discharges the oil through the oil discharge control portion of the second oil flow control valve,

wherein the second port receives the oil supply from the oil supply control portion of the second oil flow control valve, and discharges the oil through the oil discharge control portion of the first oil flow control valve,

wherein an operation state of the hydraulic servo unit is controlled by the control valve operation control means

that controls each operation of the first and the second oil flow control valves,

wherein the hydraulic servo unit comprises a toroidal type continuously variable transmission.

2. The hydraulic control apparatus according to claim 1, wherein the control valve operation control means controls only the first oil flow control valve by interrupting the control of the second oil flow control valve that supplies the oil from the pressurized oil source and passes the oil into the oil discharge passage such that the operation direction of the hydraulic servo unit is selected to the first operation direction.

3. The hydraulic control apparatus according to claim 1 or 2, wherein the control valve operation control means controls only the second oil flow control valve by interrupting the control of the first oil flow control valve that supplies the oil from the pressurized oil source and passes the oil into the oil discharge passage such that the operation direction of the hydraulic servo unit is selected to the second operation direction.

4. The hydraulic control apparatus according to any one of claims 1 to 3, further comprising oil passage selection means that selectively changes an inlet between the first port and the second port.

5. The hydraulic control apparatus according to any one of claims 1 to 4, further comprising depressurize oil supply means that supplies a pressurized oil from the pressurized oil source, which has been depressurized to at least one of the first and the second ports by bypassing

the first and the second oil flow control valves.

6. The hydraulic control apparatus according to claim 5, wherein the hydraulic servo unit comprises a transmission for a vehicle, and the pressurized oil is supplied to a port to which the pressurized oil is supplied for an upshifting operation of the transmission by the depressurize oil supply unit.

7. The hydraulic control apparatus according to claim 5 or 6, wherein the depressurize oil supply means is activated when one of the first and the second oil flow control valves fails to supply the pressurized oil.

8. The hydraulic control apparatus according to any one of claims 5 to 7, wherein an oil pressure of the pressurize oil source is temporarily increased when the depressurize oil supply means is operated.

9. The hydraulic control apparatus according to any one of claims 5 to 8, wherein a control for reducing a torque input to the hydraulic servo unit is executed when the depressurize oil supply unit is operated.

10. The hydraulic control apparatus according to any one of claims 5 to 8, wherein the hydraulic servo unit comprises a toroidal type continuously variable transmission, and an engine output of the vehicle is reduced when the depressurize oil supply means is operated.

11. The hydraulic control apparatus according to claim 1, wherein:

the toroidal type continuously variable transmission

includes a roller supported by a support member and interposed between a pair of rotating members, and an actuator having a piston connected to the support member and an upper hydraulic chamber formed above the piston and a lower hydraulic chamber formed below the piston; and

the roller is deflected with respect to the rotating members while the actuator is displacing the support member in a vertical direction.

12. The hydraulic control apparatus according to claim 11, wherein the control valve operation control means serves to activate the second oil flow control valve when the toroidal type continuously variable transmission is operated in the first operation direction, and the first oil flow control valve fails to stop supplying the oil to the lower hydraulic chamber after a flow rate of the supplied oil exceeds a predetermined target value.

13. The hydraulic control apparatus according to claim 11 or 12, wherein the control valve operation control means serves to activate the first oil flow control valve when the toroidal type continuously variable transmission is operated in the second operation direction, and the second oil flow control valve fails to stop supplying the oil to the upper hydraulic chamber after a flow rate of the supplied oil exceeds a predetermined target value.

14. A method of controlling a hydraulic control apparatus for a hydraulic servo unit that selectively changes an operation direction between a first direction when an oil is supplied from a first port and discharged from a second port and a second direction opposite to the first direction when the oil is supplied from the second

port and discharged from the first port, the hydraulic control apparatus including a first oil flow control valve and a second oil flow control valve each having an oil supply control portion that controls an oil supply from a pressurized oil source, and an oil discharge control portion that controls a connection to an oil discharge passage, the method comprising the steps of:

controlling an oil supply from the oil supply control portion of the first oil flow control valve and an oil discharge through the oil discharge control portion of the second oil flow control valve; and

controlling an oil supply from the oil supply control portion of the second oil flow control valve and an oil discharge through the oil discharge control portion of the first oil flow control valve,

wherein the hydraulic servo unit comprises a toroidal type continuously variable transmission.

15. The method according to claim 14, wherein the first oil flow control valve is only controlled by interrupting the control of the second oil flow control valve that supplies the oil from the pressurized oil source and passes the oil into the oil discharge passage such that the operation direction of the hydraulic servo unit is selected to the first operation direction.

16. The method according to claim 14 or 15, wherein the second oil flow control valve is only controlled by interrupting the control of the first oil flow control valve that supplies the oil from the pressurized oil source and passes the oil into the oil discharge passage such that the operation direction of the hydraulic servo unit is selected to the second operation direction.

17. The method according to any one of claims 14 to 16, further comprising selectively changing an inlet between the first port and the second port.

18. The method according to any one of claims 14 to 17, wherein a pressurized oil from the pressurized oil source, which has been depressurized is supplied to at least one of the first and the second port by bypassing the first and the second oil flow control valves.

19. The method apparatus according to claim 18, wherein the pressurized oil from the pressurized oil source, which has been depressurized is supplied to at least one of the first and the second port by bypassing the first and the second oil flow control valves when one of the first and the second oil flow control valves fails to supply the pressurized oil.

20. The method according to claim 18 or 19, wherein an oil pressure of the pressurize oil source is temporarily increased when the pressurized oil from the pressurized oil source, which has been depressurized is supplied.

21. The method according to any one of claims 18 to 20, wherein a control for reducing a torque input to the hydraulic servo unit is executed when the pressurized oil from the pressurized oil source, which has been depressurized is supplied.

22. The method according to any one of claims 18 to 21, wherein the hydraulic servo unit comprises a toroidal type continuously variable transmission, and an engine

output of the vehicle is reduced when the pressurized oil from the pressurized oil source, which has been depressurized is supplied.

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